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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.         | CONFIRMATION NO. |
|--|-------------|----------------------|-----------------------------|------------------|
| 10/649,643   | 08/28/2003  | Kozo Makiyama        | 031060                      | 5562             |
| 23850  | 7590        | 03/23/2005           |                             |                  |
| ARMSTRONG, KRATZ, QUINTOS, HANSON & BROOKS, LLP<br>1725 K STREET, NW<br>SUITE 1000<br>WASHINGTON, DC 20006 |             |                      |                             |                  |
|  |             |                      | EXAMINER<br>QUINTO, KEVIN V |                  |
|  |             |                      | ART UNIT<br>2826            | PAPER NUMBER     |

DATE MAILED: 03/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|--------------------------------------|--|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/649,643 | <b>Applicant(s)</b><br>MAKIYAMA ET AL. |  |
|                              | <b>Examiner</b><br>Kevin Quinto      | <b>Art Unit</b><br>2826                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2005.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-12 is/are allowed.
- 6) ☒ Claim(s) 13, 15, 16 and 22 is/are rejected.
- 7) ☒ Claim(s) 14 and 17-21 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>28 August 2003</u> .  | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Specification*

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

### *Claim Objections*

2. Claim 19 is objected to because of the following informalities: the word *hollow* is misspelled as "hallow." Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 13, 15, 16, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 10-150054) in view of Chen et al. (USPN 6,040,248).
5. In reference to claim 13, Oshima (JP 10-150054) discloses a similar device. Figures 1a-1b of Oshima illustrate a mushroom gate (5) formed on a semiconductor substrate (1). The mushroom gate (5) has an over gate formed over a fine gate which has a broadened size along the current direction. A dielectric material film (6) forms a hollow space which surrounds at least the side surfaces of the fine gate and a lower

surface of the over gate respectively of the mushroom gate (5) in the active region. The hollow space has a curved surface. Oshima does not disclose the use of an organic material for the dielectric material film. However the use of an organic dielectric is well known in the semiconductor art. Chen et al. (USPN 6,040,248, hereinafter referred to as the "Chen" reference) discloses the use of an organic dielectric layer which covers an unseen gate electrode in figure 2a (column 3, lines 21-36). Furthermore Chen discloses that the use of an organic dielectric material leads to improved integrated circuit performance (column 1, lines 31-46). In view of Chen, it would therefore be obvious to use an organic dielectric as the dielectric material film in the device of Oshima.

6. In reference to claim 15, either side of the Oshima gate can be the source side or the drain side. Thus in figures 1a-1b, the hollow space surrounds a source side region of the mushroom gate (5) and touches a lower surface of the over gate. An upper surface of the over gate of the mushroom gate on the drain side contacts the dielectric material film (6).

7. With regard to claim 16, the hollow space occupies a region under the over gate of the mushroom gate (5). The dielectric material (6) covers the over gate.

8. In reference to claim 22, Oshima (JP 10-150054) discloses a similar device. Figure 1a-1b of Oshima illustrate a mushroom gate (5) formed on a semiconductor substrate (1). The mushroom gate (5) traverses an active region. It is understood that a plurality of mushroom gates are formed; each of them traversing their own active region. The mushroom gate (5) has an over gate formed over a fine gate which has a

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broadened size along the current direction. A dielectric material film (6) forms a hollow space which surrounds at least the side surfaces of the fine gate and a lower surface of the over gate respectively of the mushroom gate (5) in the active region. The hollow space has a curved surface. Oshima does not disclose the use of an organic material for the dielectric material film. However the use of an organic dielectric is well known in the semiconductor art. Chen (USPN 6,040,248) discloses the use of an organic dielectric layer which covers an unseen gate electrode in figure 2a (column 3, lines 21-36). Furthermore Chen discloses that the use of an organic dielectric material leads to improved integrated circuit performance (column 1, lines 31-46). In view of Chen, it would therefore be obvious to use an organic dielectric as the dielectric material film in the device of Oshima.

9. Claims 13, 15, 16, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 10-150054) in view of Chen et al. (USPN 6,040,248).

10. In reference to claim 13, Oshima (JP 10-150054) discloses a similar device. Figures 4a-4d of Oshima illustrate a mushroom gate (5) formed on a semiconductor substrate (1). The mushroom gate (5) has an over gate formed over a fine gate which has a broadened size along the current direction. A dielectric material film (23) forms a hollow space which surrounds at least the side surfaces of the fine gate and a lower surface of the over gate respectively of the mushroom gate (5) in the active region. Oshima does not disclose the use of an organic material for the dielectric material film. However the use of an organic dielectric is well known in the semiconductor art. Chen (USPN 6,040,248) discloses the use of an organic dielectric layer which covers an

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unseen gate electrode in figure 2a (column 3, lines 21-36). Furthermore Chen discloses that the use of an organic dielectric material leads to improved integrated circuit performance (column 1, lines 31-46). In view of Chen, it would therefore be obvious to use an organic dielectric as the dielectric material film in the device of Oshima. The examiner notes the limitation regarding the curved surface of the hollow surface. Although the Oshima device does not teach the exact shape of the hollow surface as that claimed by Applicant:

The shape, size, dimension differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416.

Therefore claim 13 is not patentably distinguishable over the Oshima and Chen reference.

11. In reference to claim 15, either side of the Oshima gate can be the source side or the drain side. Thus in figures 4a-4d, the hollow space surrounds a source side region of the mushroom gate (5) and touches a lower surface of the over gate. An upper surface of the over gate of the mushroom gate on the drain side contacts the dielectric material film (23).

12. With regard to claim 16, the hollow space occupies a region under the over gate of the mushroom gate (5). The dielectric material (23) covers the over gate.

13. In reference to claim 22, Oshima (JP 10-150054) discloses a similar device. Figures 4a-4d of Oshima illustrate a mushroom gate (5) formed on a semiconductor substrate (1). The mushroom gate (5) traverses an active region. It is understood that a plurality of mushroom gates are formed; each of them traversing their own active

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region. The mushroom gate (5) has an over gate formed over a fine gate which has a broadened size along the current direction. A dielectric material film (23) forms a hollow space which surrounds at least the side surfaces of the fine gate and a lower surface of the over gate respectively of the mushroom gate (5) in the active region. Oshima does not disclose the use of an organic material for the dielectric material film. However the use of an organic dielectric is well known in the semiconductor art. Chen (USPN 6,040,248) discloses the use of an organic dielectric layer which covers an unseen gate electrode in figure 2a (column 3, lines 21-36). Furthermore Chen discloses that the use of an organic dielectric material leads to improved integrated circuit performance (column 1, lines 31-46). In view of Chen, it would therefore be obvious to use an organic dielectric as the dielectric material film in the device of Oshima. The examiner notes the limitation regarding the curved surface of the hollow surface. Although the Oshima device does not teach the exact shape of the hollow surface as that claimed by

Applicant:

The shape, size, dimension differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416.

Therefore claim 22 is not patentably distinguishable over the Oshima and Chen reference.

***Allowable Subject Matter***

14. Claims 1-12 are allowed.

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15. Claims 14, 17, 18, 20, and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. The following is a statement of reasons for the indication of allowable subject matter: the examiner is unaware of any prior art which suggests or renders obvious a fabrication method for a semiconductor device having a t-shaped gate with a hollow space beneath it that is formed by depositing two organic materials on the gate such that the lower organic material is dissolved (thereby leaving the hollow space).



***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KVQ

  
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